

CLAIMS:

1. A method for making a single-crystal, high density body containing at least about 90 weight % of tungsten, said method comprising:
providing a chamber suitable for carrying out chemical vapor deposition (CVD),
locating a stable single-crystal substrate within said chamber,
providing a vapor atmosphere containing chlorides or fluorides of tungsten in said CVD chamber, and
heating said single-crystal substrate to a temperature between 1600°C and 2200°C so as to cause a single-crystal tungsten body to grow upon the exterior surface of said single-crystal substrate and create a high-density tungsten body.
2. The method according to claim 1 wherein said substrate is a thin wire which is aligned with the [100] orientation with respect to its long axis.
3. The method according to claim 2 wherein said single-crystal substrate is formed of a metal or an alloy of metals having a body-centered cubic crystal structure.
4. The method according to claim 3 wherein said substrate is molybdenum, tungsten, niobium or tantalum, or an alloy thereof.
5. The method according to claim 1 wherein said heating is continued until said single-crystal body has grown to have a diameter of at least about 3 mm.
6. The method according to claim 1 wherein said vapor atmosphere contains a minor amount of chlorides or fluorides of tantalum, rhenium, niobium and/or molybdenum and wherein said single crystal tungsten body is an alloy of tungsten and tantalum, rhenium, niobium and/or molybdenum.
7. An economical method for making a single-crystal, high density body containing a major amount of tungsten, said method comprising:
providing a chamber suitable for carrying out chemical vapor deposition (CVD) which can be periodically closed to outlet flow therefrom,

locating a stable, single-crystal substrate within said chamber,
providing a solid feedstock in the form of a major amount of elemental tungsten in said CVD chamber,
heating said substrate to at least about 800°C and heating said solid feedstock to a temperature of at least about 700°C but below that of said substrate, and
initially introducing vapor into said chamber containing chlorine or fluorine and then discontinuing vapor flow into or out of said chamber to cause the deposition of a single-crystal tungsten body upon said substrate with the simultaneous creation of Cl₂ or F₂ vapor which reacts with said heated solid feedstock to form metal halide vapors that then react at said substrate.

8. The method according to claim 7 wherein said chamber is periodically evacuated and the atmosphere of said evacuated chamber is resupplied with said vapor initially introduced.

9. The method according to claim 7 wherein said vapor contains chlorine, wherein said single-crystal substrate and said growing single-crystal body are heated to a temperature between about 1600°C and about 2200°C, and wherein said feedstock is heated to a temperature which is not above about 900°C.

10. The method according to claim 7 wherein said vapor contains tungsten fluoride and hydrogen, causing the deposition of elemental tungsten upon said substrate with the simultaneous creation of HF, which HF subsequently reacts with said heated solid feedstock to form additional metal vapors.

11. The method according to claim 7 wherein said substrate is a thin wire which is aligned with the [100] orientation with respect to its long axis.

12. The method according to claim 11 wherein said single-crystal substrate is formed of a metal or an alloy of metals having a body-centered cubic crystal structure.

13. The method according to claim 7 wherein said heating is continued until said single-crystal body has grown to have a diameter of at least about 3 mm.

14. The method according to claim 7 wherein said feedstock contains a minor amount of tantalum, rhenium, niobium and/or molybdenum as an alloying metal and wherein said single crystal tungsten body is an alloy of tungsten and a minor amount of said elemental alloying metal or metals.

15. A method for making a single-crystal, high density body containing a major amount of tungsten, said method comprising:

providing a chamber suitable for carrying out chemical vapor deposition (CVD),

locating a stable, single-crystal substrate within said chamber,

providing a solid feedstock in said chamber in the form of a major amount of elemental tungsten at a location upstream of said substrate,

heating said substrate to at least about 800°C and heating said solid feedstock to a temperature of at least about 700°C but below that of said substrate, and

causing chlorine or fluorine vapor to flow into and through said chamber to cause an initial reaction with said heated solid feedstock to form metal halide vapors that then react at said substrate to effect deposition of a single-crystal tungsten body upon said substrate.

16. The method according to claim 15 wherein said vapor contains chlorine, wherein said single-crystal substrate and said growing single crystal body are heated to a temperature between about 1600°C and about 2200°C, and wherein said feedstock is heated to a temperature which is not above about 900°C.

17. The method according to claim 15 wherein said substrate is a thin wire which is aligned with the [100] orientation with respect to its long axis.

18. The method according to claim 17 wherein said single-crystal substrate is formed of a metal or an alloy of metals having a body-centered cubic crystal structure.

19. The method according to claim 15 wherein said heating is continued until said single-crystal body has grown to have a diameter of at least about 3 mm.

20. The method according to claim 15 wherein said feedstock contains a

minor amount of tantalum, rhenium, niobium and/or molybdenum as an alloying metal and wherein said single crystal tungsten body is an alloy of tungsten and said elemental alloying metal or metals.